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MACTEC ENVIRONMENTAL RESTORATION SERVICES, LLC

Spectral Gamma-Ray Borehole
Log Data Report

Borehole 10-01-05

Log Event A

Borehole Information

Farm : A	**Tank :** A-101	**Site Number :** 299-E25-1
N-Coord : 41,166	**W-Coord :** 47,759	**TOC Elevation :** 690.57
Water Level, ft : 289.30	**Date Drilled :** 2/28/55	

Casing Record

Type : Steel-welded	Thickness, in. : 0.313	ID, in. : 8
Top Depth, ft. : 0	Bottom Depth, ft. : 315	
Type : Steel-welded	Thickness, in. : 0.250	ID, in. : 4
Top Depth, ft. : 0	Bottom Depth, ft. : 275	

Cement Bottom, ft. : 275 **Cement Top, ft. :** 0

Borehole Notes:

This borehole was originally drilled in February 1955 and was completed at a depth of 322 ft with 8-in. casing. The 8-in. pipe was perforated from 310 to 280 ft. In 1976, the borehole was cleaned to a depth of 315 ft. A 5-ft cement plug was placed in the bottom of the borehole, making the total completion depth 310 ft. The driller's log reports that the 8-in. casing was perforated from 270 to 90 ft and from 20 ft to the ground surface at a rate of 2 cuts per round and 1 round per foot. A 4-in. steel pipe was inserted into the 8-in. casing to a depth of 275 ft; a packer (consisting of an annular seal in the 4-in. casing and a solid seal in the 8-in. casing a few feet below the annular seal) was set with the annular seal in the inner casing at a depth of 275 ft. Cement grout was injected into the packer and up into the annular space between the two casings and through the perforations into the sediments surrounding the 8-in. casing.

The description of the borehole construction is apparently incomplete. The SGLS logs indicate a change of casing type at a depth of 235 ft. The inner casing was apparently installed to a depth of 235 ft and the grouting probably started at a depth of 235 ft, rather than the 275-ft depth indicated in the drilling records.

The top of the casing is the zero reference for the log. The casing lip is 5 in. above the ground surface.

Equipment Information

Logging System : 2	**Detector Type :** HPGe	**Detector Efficiency:** 35.0 %
Calibration Date : 10/1996	**Calibration Reference :** GJO-HAN-13	**Logging Procedure :** P-GJPO-1783

Logging Information

Log Run Number : 1	**Log Run Date :** 12/04/1996	**Logging Engineer:** Gary Lekvold
Start Depth, ft.: 0.0	**Counting Time, sec.:** 100	**L/R :** L **Shield :** N
Finish Depth, ft. : 14.5	**MSA Interval, ft. :** 0.5	**Log Speed, ft/min.:** n/a

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Log Run Number :	2	**Log Run Date :**	12/05/1996	**Logging Engineer:**	Gary Lekvold
Start Depth, ft.:	250.0	**Counting Time, sec.:**	100	**L/R :** L	**Shield :** N
Finish Depth, ft. :	212.5	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Run Number :	3	**Log Run Date :**	12/06/1996	**Logging Engineer:**	Gary Lekvold
Start Depth, ft.:	13.5	**Counting Time, sec.:**	100	**L/R :** L	**Shield :** N
Finish Depth, ft. :	45.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Run Number :	4	**Log Run Date :**	01/02/1997	**Logging Engineer:**	Bob Spatz
Start Depth, ft.:	44.0	**Counting Time, sec.:**	100	**L/R :** L	**Shield :** N
Finish Depth, ft. :	77.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Run Number :	5	**Log Run Date :**	01/03/1997	**Logging Engineer:**	Bob Spatz
Start Depth, ft.:	213.5	**Counting Time, sec.:**	100	**L/R :** L	**Shield :** N
Finish Depth, ft. :	127.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Run Number :	6	**Log Run Date :**	01/06/1997	**Logging Engineer:**	Bob Spatz
Start Depth, ft.:	128.0	**Counting Time, sec.:**	100	**L/R :** L	**Shield :** Y
Finish Depth, ft. :	76.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Run Number :	7	**Log Run Date :**	01/06/1997	**Logging Engineer:**	Bob Spatz
Start Depth, ft.:	249.0	**Counting Time, sec.:**	100	**L/R :** L	**Shield :** N
Finish Depth, ft. :	257.5	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Run Number :	8	**Log Run Date :**	01/07/1997	**Logging Engineer:**	Bob Spatz
Start Depth, ft.:	256.5	**Counting Time, sec.:**	100	**L/R :** L	**Shield :** N
Finish Depth, ft. :	277.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Logging Operation Notes:

This borehole was logged in eight log runs. The total logging depth achieved by the SGLS was 277 ft. A depth return error of 3.5 in. occurred on the second log run. The borehole is accessible below this depth but the logging engineers feared that the logging cable might be severed by the base of the 4-in. casing that was reported at this depth.

Analysis Information

Log Event A

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Data Processing Reference : MAC-VZCP 1.7.9 Analysis Date : 02/10/1998

Analysis Notes :

The pre- and post-survey field verification spectra for all logging runs met the acceptance criteria established for peak shape and system efficiency. The energy calibration and peak-shape calibration from these spectra were used to establish the peak resolution and channel-to-energy parameters used in processing the spectra acquired during the logging operation.

The thickness and density of the grout could not be determined; therefore, a correction for the attenuating effects of the grout could not be determined.

Log Plot Notes:

Separate log plots show the man-made and the naturally occurring radionuclides. The natural radionuclides can be used for lithology interpretations. The headings of the plots identify the specific gamma rays used to calculate the concentrations. Uncertainty bars on the plots show the statistical uncertainties for the measurements as 95-percent confidence intervals. Open circles on the plots give the MDL. The MDL of a radionuclide represents the lowest concentration at which positive identification of a gamma-ray peak is statistically defensible.

A combination plot includes the man-made and natural radionuclides, the total gamma derived from the spectral data, and the Tank Farms gross gamma log. The gross gamma plot displays the latest available digital data. No attempt has been made to adjust the depths of the gross gamma logs to coincide with the SGLS data.

Results/Interpretations:

The only man-made radionuclide detected in this borehole was Cs-137. Cs-137 contamination was detected continuously from the ground surface to 7.5 ft and at intermittent locations just above the MDL in the rest of the borehole.

The K-40 log plot shows an interval of slightly lower concentrations between approximately 50 and 80 ft. At a depth of 215 ft the U-238 concentration increases slightly. At 235 ft, the K-40 concentration values increase sharply and the Th-232 concentrations increase slightly below this depth. Below a depth of 275 ft, the concentration of all the naturally occurring radionuclides increases sharply.

An analysis of the shape factors associated with applicable segments of the spectra was performed. The shape factors provide insights into the nature of the distribution of contaminants in the soil surrounding the borehole and into nature of zones of elevated total count gamma-ray activity not attributable to gamma-emitting radionuclides. However, plots of the shape factor are not included with this discussion. Shape factor analysis for the interval in which man-made radionulides occurred (from the ground surface to about 6.5 ft) is not valid because of the presence of grout on the outside of the borehole casing. Contaminant concentrations throughout the rest of the borehole were below the threshold required for reliable shape factor calculations.

Additional information and interpretations of log data are included in the main body of the Tank Summary Data Report for tank A-101.